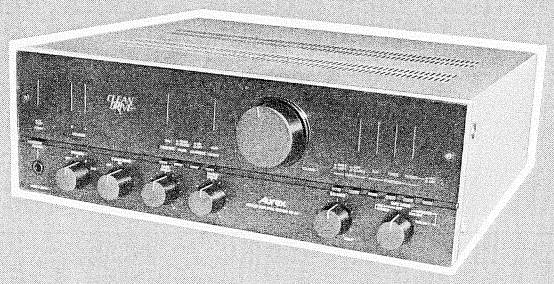
**SERVICE DATA**
**FILE-NO. 170-119**

# TOSHIBA

## STEREO AMPLIFIER

# SB-66



### SPECIFICATIONS

■ **General**

| | |
|---|---|
| **Power Supply:** | 220V ∿ 50 Hz for Europe<br>240V ∿ 50 Hz for United Kingdom & Australia |
| **Power Consumption:** | 460W |
| **Weight:** | 10 kg |
| **Dimensions (WxHxD):** | 420 x 151 x 399 (mm) |

■ **Amplifier**

| | |
|---|---|
| **Continuous Power Output** | |
| **20 Hz ∿ 20kHz** | |
| **both ch. driven:** | 60W x 2 (4Ω), 60W x 2 (8Ω) |
| **1 kHz both ch. driven:** | 62W x 2 (4Ω), 62W x 2 (8M) |
| **Total Harmonic Distortion:** | 0.015 (at rated power 8Ω) |
| **Frequency Response:** | 5 Hz∿100 kHz (+ 0dB,– 3dB) |
| **Power Band Width (IHF):** | 10 Hz ∿ 35 kHz |
| **Damping factor:** | 30 (CLEAN DRIVE OFF) |
| **S/N (IHF A Network):** | 106 (TUNER/AUX)<br>86 dB (PHONO-MM)<br>69 dB (PHONO-MC) |
| **Input Sensitivity/ Impedance:** | PHONO (MM) 2.5mV/47 kΩ<br>PHONO (MC) 0.25mV/100Ω<br>TUNER 150mV/50 kΩ<br>AUX/TAPE 150mV/50kΩ |
| **Output Level:** | TAPE REC 150mV |
| **Tone Control:** | BASS (at 100 Hz) ± 8 dB<br>TREBLE (at 10 kHz) ± 8 dB |
| **Phono Overload Level:** | MM 200mV (RMS)<br>MC 18mV (RMS) |

Specifications and design are subject to change withoutn notice.

TE,TU,AY

# CONTENTS


1. BLOCK DIAGRAM . . . . . 2
2. OPERATING CONTROLS . . . . . 3
3. SYSTEM CONNECTIONS . . . . . 4
4. OPERATION . . . . . 5 to 6
5. DISASSEMBLY INSTRUCTIONS . . . . . 6 to 7
6. ADJUSTMENTS . . . . . 8
7. TECHNICAL INSTRUCTIONS . . . . . 9 to 11
8. ELECTRICAL PARTS LOCATIONS . . . . . 12
9. SCHEMATIC DIAGRAM . . . . . 13
10. IC BLOCK DIAGRAM . . . . . 14
11. CABINET PARTS LOCATIONS . . . . . 15
12. PARTS LIST . . . . . 16 to 19


# 1. BLOCK DIAGRAM

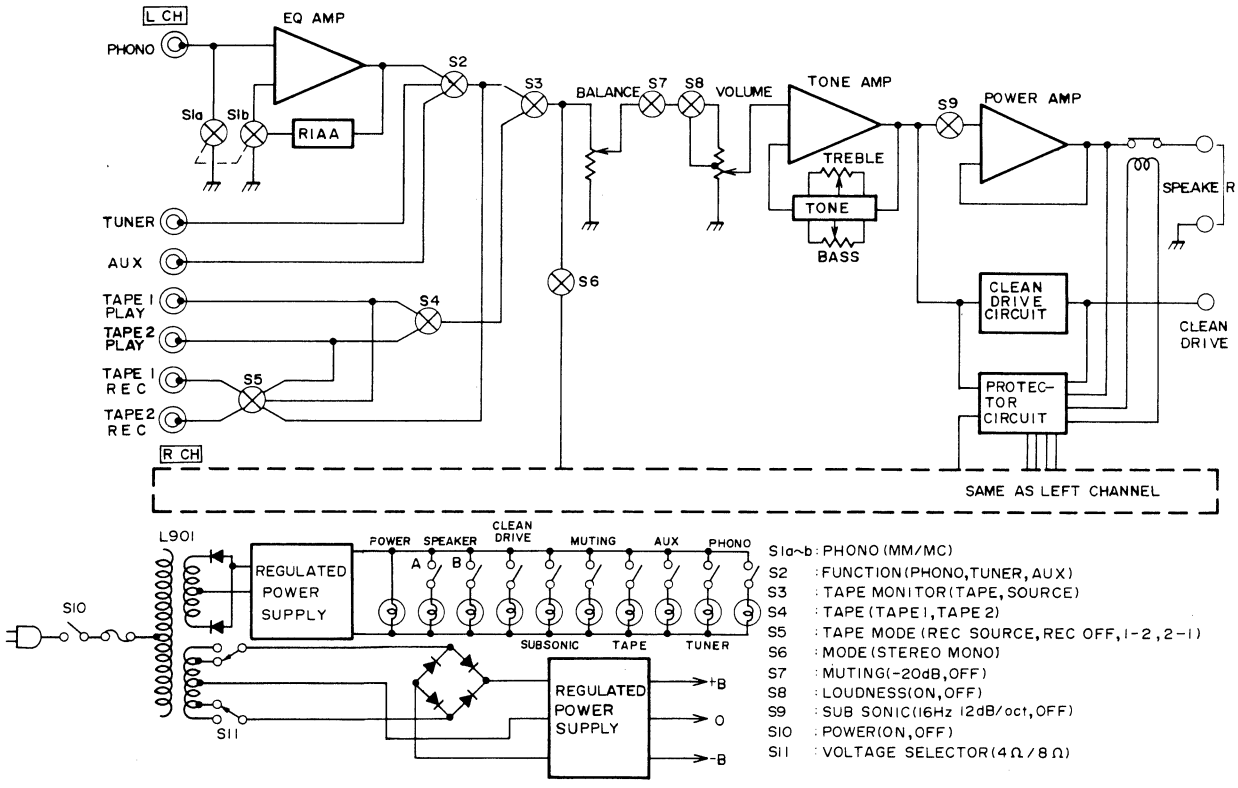



**Figure 1**

# 2. OPERATING CONTROLS

**Muting indicator**

**Loudness**
Turn this switch ON when listening at low volume levels to emphasize the high and low frequencies.

**Mode select switch**
Selects the stereo or monaural mode.

**Subsonic indicator**

**CLEAN DRIVE indicator**

**Speaker indicator**

**Power indicator**

**Power switch**
Press to turn the set ON. When the set comes ON, the Power indicator 2 will light.

**Phones**
Connect the headphone plug to this jack.

**Speaker switch**
This switch controls the rear panel speaker terminals.
A: Sound output from the speaker system connected to the A terminals. The Clean Drive system can be used with this speaker system.
B: Sound output from the speaker system connected to the B terminals.
A + B: Sound output from both the A and B speaker systems.
OFF: Only the headphones operate.

**CLEAN DRIVE switch**

**Subsonic filter**
Turn this switch ON to eliminate low frequency noise (caused mainly by record warps).

**Bass and Treble controls**
Turn the bass or treble tone control clockwise from the centre (tone defeat) position to emphasize bass or treble tones. Turn counterclockwise to decrease bass or treble tones.

**Muting switch**
This switch is used to temporarily reduce volume, for example, when you want to cut out stylus contact noise while cueing. When this switch is turned ON, volume will be reduced by about 20 dB and the muting indicator will illuminate.

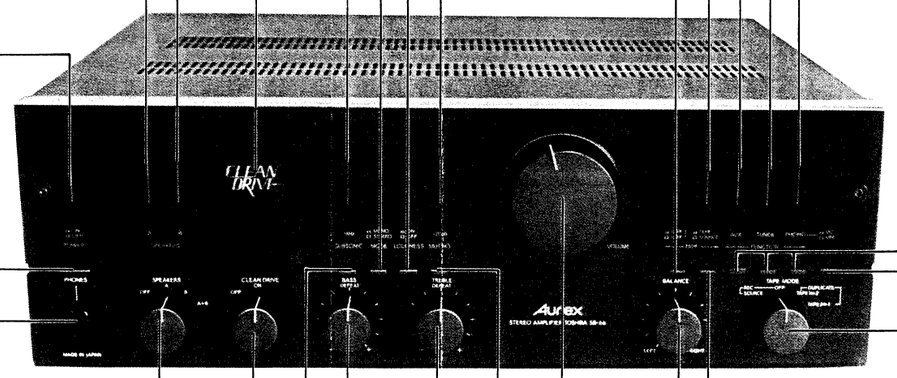



Figure 2

**TAPE 1/TAPE 2 switch**
Switch to the TAPE 1 position to listen to the tape deck connected to the TAPE 1 terminals on the rear panel and the TAPE 2 position for the deck connected to the TAPE 2 terminals.

**Tape monitor indicator**

**Function indicator**

**Function**
These switches select the desired program source.
AUX. . . . . .for use with any audio component
PHONO. . . . . .for record player or turntable
TUNER. . . . . .for AM/FM stereo tuner
The function switches will not lock. Press gently but firmly.

**MC/MM cartridge switch**
Switch to the MC position when using an MC-type cartridge and the MM position when using an MM-type cartridge.

**Tape mode switch**
Use this switch when performing recording operations or when recording (dubbing) from one tape deck to another.
REC SOURCE: The source selected by the function switch can be recorded.
REC OFF: No signal is fed to the REC terminals.
TAPE 1 ▶ 2: To record (dub) a program from the deck connected to the TAPE 1 terminals to the deck connected to the tape 2 terminals.
TAPE 2 ▶ 1: To record in the opposite direction as the TAPE 1 ▶ 2 setting.

**Tape/Source Switch**
When playing a component connected to PHONO (turntable), TUNER (AM/FM stereo tuner), or AUX (any other component) place this switch to the SOURCE position. When a tape deck is connected and it is played, set to TAPE. In the TAPE position the green indicator above the switch will light.
- Do not change from Source to Tape, while recording because this will interrupt the source input.

**Balance**
This control is used to adjust volume balance between the left and right speakers.

**Volume**
Use this control to adjust the volume level.

# 3. SYSTEM CONNECTIONS

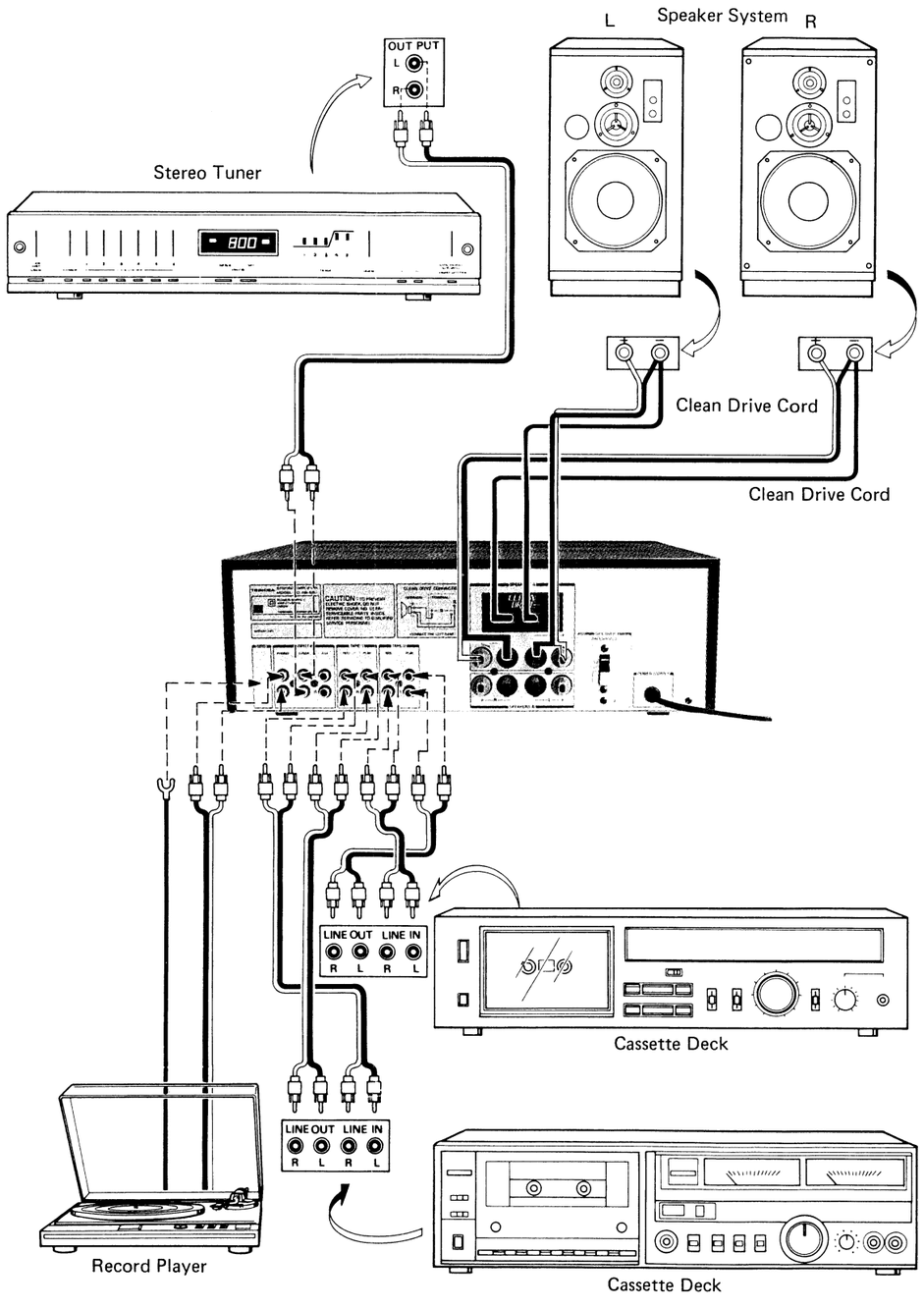



**Figure 3**



# 4. OPERATION

(refer to Fig. 2)

**Note:** Until all connections have been properly completed, do not plug the unit into the power supply receptacle or turn on the power switch.

■ **Connection of speakers to the power amplifier**

Connect the right speaker cord to the "R" terminal (speaker) and the left speaker to the "L" terminal (speaker) on the rear panel of the amplifier. Make sure the positive (+) cord is connected to the (+) terminal and the negative (–) and clean drive cords to the (–) terminal. Crossing these cords will cause loss of stereo output.

* For speakers where the cords can not be disconnected, refer to page 17 for directions on connecting the clean drive cords.
* Make absolutely certain the power switch of the amp is OFF when this connection is made.
* Do not short-circuit the positive and negative speaker connection.

**Note** Use speakers with an impedance of at least 4 ohms (preferably 8 ohms) to avoid overloading the amplifier.

● **Speaker impedance selector (Rear panel)**

This selector is set in relevant position according to the chart below when shipped. It may cause overheating when using speakers of less than 8 ohm rating are used with this selector in 8 ohm position (especially those of U.K. and Australia models). If the desired speakers are of different impedance from the chart below, consult with dealer.

| Area | Selector | Usable Speaker | Power Supply |
|---|---|---|---|
| Europe | 4Ω | 4Ω or more | AC 220V |
| The U.K. and Australia | 8Ω | 8Ω or more | AC 240V |

■ **Confirm that the front panel controls are in the following positions before the power is turned on:**

1. Volume control all the way to the left (minimum).
2. Tape/Source switch in the SOURCE position.
3. Balance in centre position.
4. Tone controls (BASS, TREBLE) in centre zero position.

■ **Using a turntable**

Connect the output cables from the turntable to the PHONO terminals of the amplifier. If the turntable is equipped with a ground wire, or the instruction manual recommends the use of one, be sure to connect it to the GND terminal of the amplifier. Failure to do this may result in hum or howling noise.

■ **AM/FM broadcasts**

Connect the tuner output cables to the TUNER input terminals on the rear panel of the amplifier. No ground between the tuner and amp is necessary.

■ **Component connected to AUX**

Depress the AUX function switch, and operate the component in accordance with its instruction manual. Adjust volume and tone as desired.

■ **Clean Drive**

The role of an audio amplifier is to faithfully amplify the incoming signal and feed the amplified signal into the loudspeakers. Distortion is the amount by which the amplifier alters the incoming signal. The standard distortion value quoted for amplifiers is measured when a not-inductive, purely ohmic resistance is connected as the load. This value becomes one order of magnitude higher if distortion is measured at the speaker input terminals in an actual-use situation. That means the amplifier is not doing its job of simply amplifying the signal without adding its own coloration.

The clean drive system was developed with the purpose of allowing the amplifier to do its job as nearly perfectly as possible. Furthermore, clean drive not only assures faithful signal amplification, it also drives the speakers with that same unaltered siganl.

● **The principle of Clean Drive**

As can be seen in the diagram, sensor cords are connected to each speaker's (–) terminal. When the clean drive switch is off, the system operates like any conventional system. There is a large amount of distortion at speaker terminals B and B' due to the back electromotive force generated by the movement of the speaker voice coils. When the switch is turned on, the clean drive system detects these spurious signals generated by the speakers and feeds them back to the amplifier where they are cancelled out. Since the amplifier is now free of this source of distortion, its full capabilities can be used to drive the speakers without adding anything spurious to the amplified signal.

● **The Benefits of Clean Drive**

The clean drive system improves sound quality in the following ways:

1. Harmonic distortion at the speaker terminals is less than one tenth that of previous systems.
2. Intermodulation distortion is significantly reduced.
3. Frequency response is virtually flat.
4. Optimum performance can be obtained with no adjustments regardless of the type of speakers and speaker cords.
5. The influence of speaker cords on sound quality is eliminated.

**(1) Right speaker unit:**

1. Cut the speaker cord as far from the amplifier as possible leaving enough to connect the clean drive connector to the speaker. Peel back a little of the sheath to expose the bare wire on both cut ends.
2. Connect the speaker (+) and (–) cords to the respective (+) and (–) terminals on the clean drive connector (a and b).
3. Connect the right clean drive terminal (using the clean drive cord) and Speaker A right channel (–) terminal (using the speaker cord) of the SB-66 to terminal d.
4. Connect the Speaker A right channel (+) terminal on the SB-66 to terminal c.

**(2) Connect the left speaker unit in the same manner.**

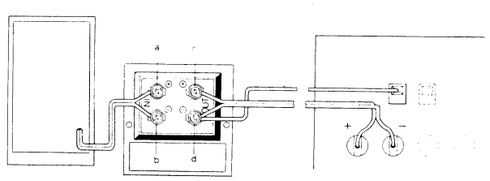


**Figure 4**

**Location**

This is a high grade component incorporating transistors of very high reliability. Since transistors are particularly sensitive to excessive heat, always keep this set in a dry, well ventilated, and flat location away from direct sunlight and free of dust. Good ventilation is important in assisting heat radiation, so do not rest this set on a soft, thick cloth. When placing the unit in an audio rack, be sure to leave enough space on all sides to allow sufficient ventilation.
Stacking with a tape deck will cause hum. If stacked, leave a wide space, or place in side-by-side configuration.

# 5. DISASSEMBLY INSTRUCTIONS

**REMOVAL OF TOP COVER**

1. Remove six screws (A) (4$\phi$ x 10mm) from both side of top cover, then top cover can be removed from unit as shown in Figure 5.

**REMOVAL OF BOTTOM PLATE**

1. Remove five screws (B) (3$\phi$ x 8mm) holding bottom plate, then bottom plate can be removed from the unit and P.C. Board can be checked easily as shown in Figure 6.

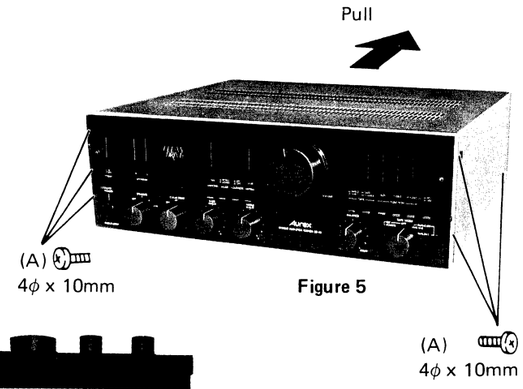



**Figure 5**

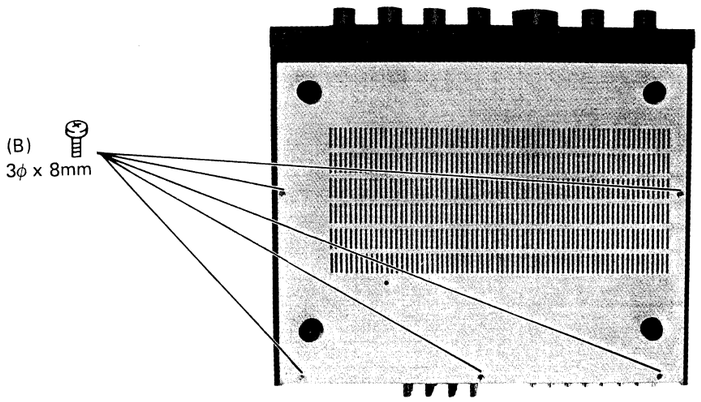



**Figure 6**



**REMOVAL OF FRONT PANEL**

1. Remove top cover as shown in Figure 5.
2. Remove seven knobs (C) as shown in Figure 7.
3. Remove one screw (D) (3$\phi$ x 16mm) placed under volume knob and hex nut holding VR ring.
   Remove four screws (E) (3$\phi$ x 8mm) placed under clean drive knob and tape mode knob.
   Remove hex nuts holding speaker knob, vaias knob vaias knob and balance knob as shown in Figure 8.

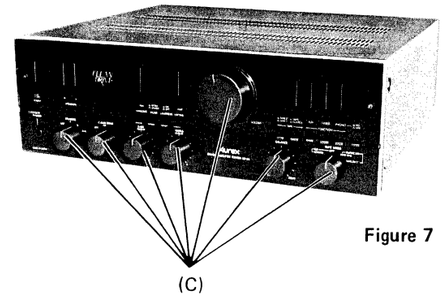



**Figure 7**

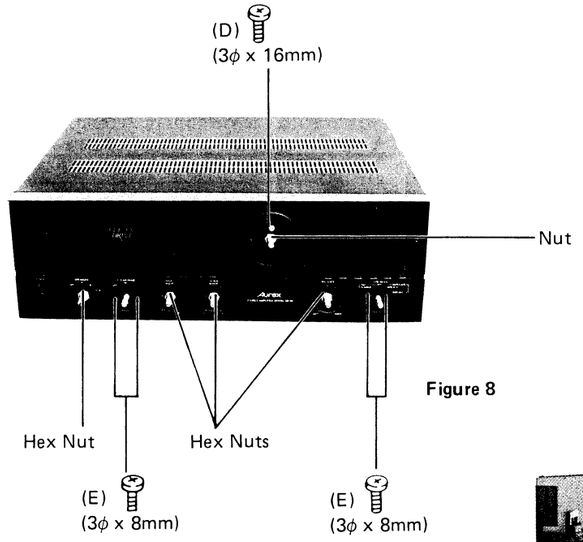



**Figure 8**

4. Remove four screws (F) (3$\phi$ x 8mm) of side panel plate holding side plate as shown in Figure 9 and 10.
5. Remove P.C. Board and other installated panels. Then, panel can be removed from unit.

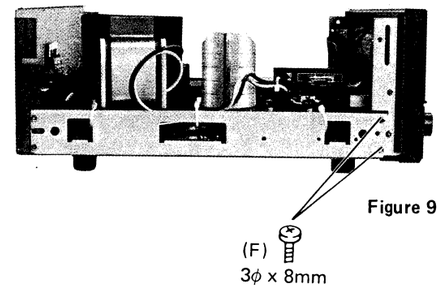



**Figure 9**

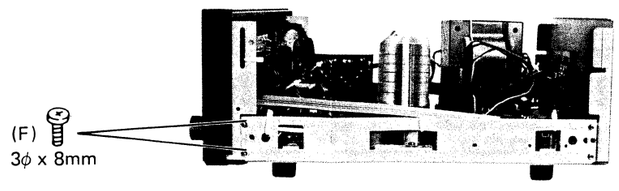
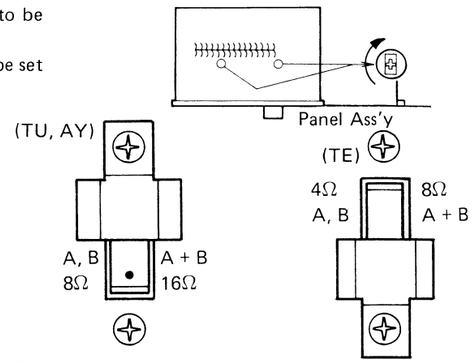



**Figure 10**

# 6. ADJUSTMENTS

**ADJUSTMENT PREPARATION**

- R631, R632 are turned to the arrow direction to be perpendicular to the front panel.
- Switch S903 (Speaker Impedance Switch) must be set in the 8Ω position.




**※ CAUTION**

When using TE, exchange the bracket and change switch to the 8 ohm position.

1. Idle current adjustment can easily be done by setting the semi-fixed VR R631, 632 (470 ohm) to mechanical mid point VR as shown in Figure 11 .
2. The idle current between TP and TP must be less than 30 mA when power has been on for 60 seconds.

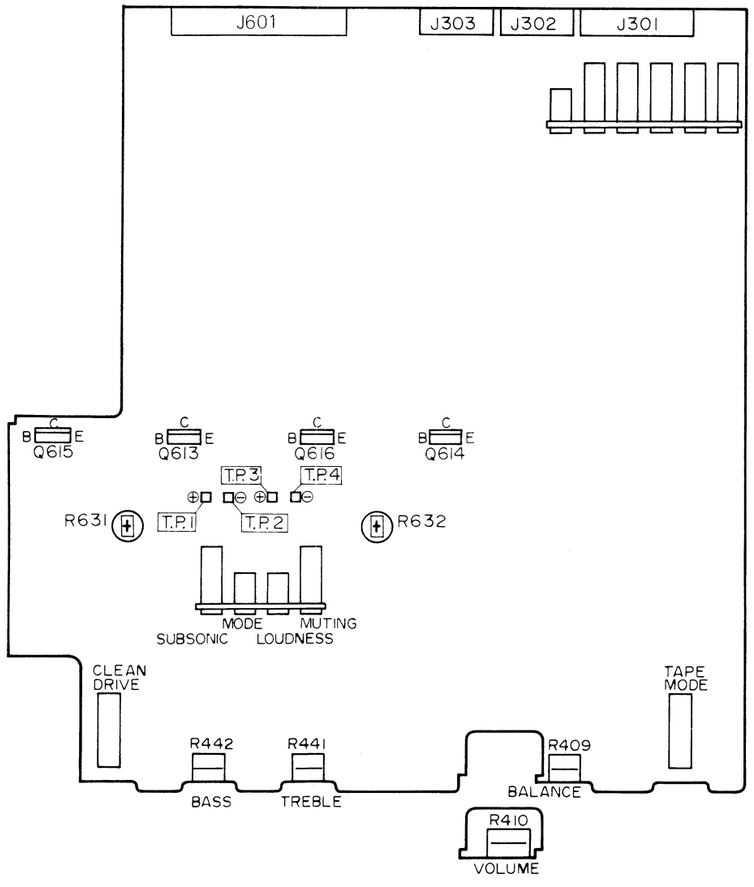



**Figure 11**



# 7. TECHNICAL INSTRUCTIONS

## Clean drive system

### Purpose of Development

In a conventional amplifier, even if an input signal is faithfully amplified, the signal becomes unclear with much distortion at the speaker input terminal owing to a distortion generated in the speaker. This obstructs display of full performance of an amplifier and speaker. Aurex solves this problem by a newly developed clean drive system. The clean drive system drives a speaker with a clean signal faithful to an input signal. This system realizes displaying full performance of an amplifier and speaker.

### Effects of Clean Drive System

Unlike a conventional amplifier, an amplifier of the clean drive system has a distortion element detection cord to be connected to the minus side of a speaker terminal and the amplifier terminal. With this cord, a distortion element generated in a speaker is detected, and based on this detection signal, the amplifier outputs a signal with minimized distortion.

1 **A high frequency distortion factor is improved to about 1/10 (at the speaker input terminal, as compared with our conventional system).**

- A high frequency distortion factor is a ratio of the integer multiple of the frequency element other than the input waveform appeared in the output when a sign wave signal of certain frequency is entered. A larger high-frequency distortion factor degrades tone quality.

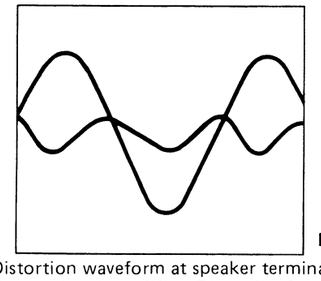


**Figure 12**

Distortion waveform at speaker terminal
Conventional amplifier (Distortion factor: 0.2%)

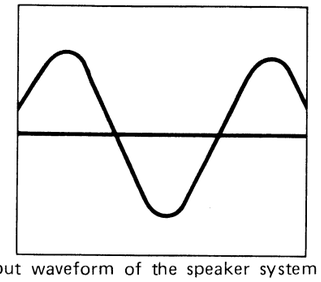


**Figure 13**

Input waveform of the speaker system of the clean drive system (Distortion factor: 0.005%)

2 **Generation of a intermodulation distortion (IM) is largely suppressed (at the speaker terminal, as compared with our conventional system). The effect is great particularly in a multi-way speaker such as 2-way and 3-way.**

- An intermodulation distortion is an element other than an input waveform, which is generated when a compound wave consisting of two or more sine waves, and has a relation of sum or difference with these frequencies. Since the intermodulation distortion generates in the frequency that is not in the integer ratio relationship, it considerably disturbs tone quality.

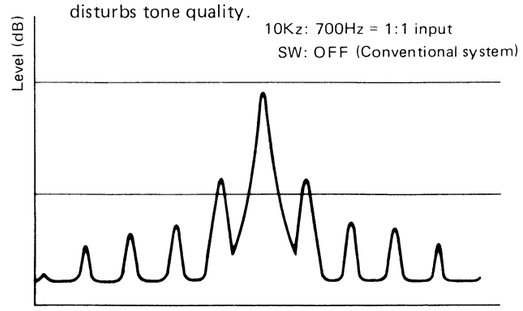



**Figure 14**

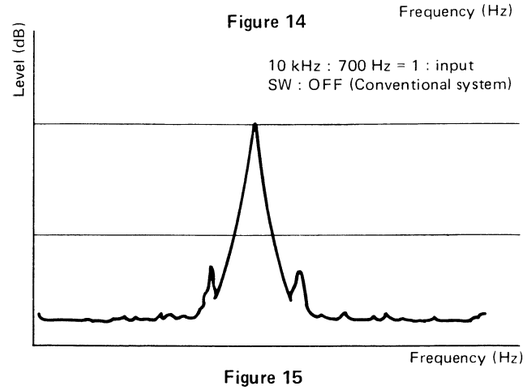



**Figure 15**

3 **A frequency response is remarkably improved, as flat as an ideal characteristic (at the speaker input terminal, as compared with our conventional system).**

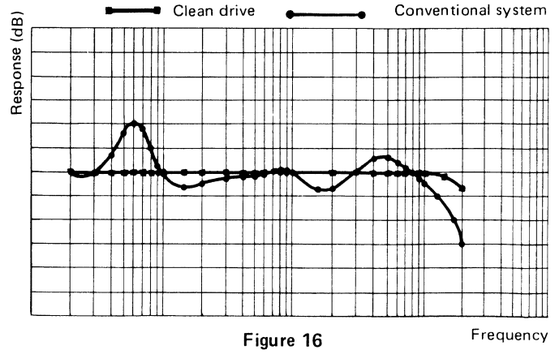
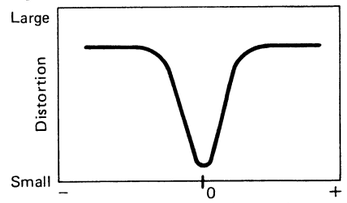



**Figure 16**

**4 A distortion can be minimized in any combination regardless of the kind of speakers to be connected.**




Impedance of the amplifier at the speaker terminal

**Figure 17**

**5 An influence of the impedance of the speaker cord is very small. It is unnecessary to consider the length, thickness and kind of a cord.**

**6 A power amplifier itself is fully used, and degradation of tone quality is little, providing an optimum effect without adjustment.**

Since use of the clean drive system decreases remarkably a high-frequency distortion factor and generation of an intermodulation distortion, an input signal can be reproduced with high fidelity, resulting (1) clean high-frequency range, (2) clear middle-range sound and (3) solid low-range sound.

The tone quality is improved in all frequency ranges.

## What is the Clean Drive System

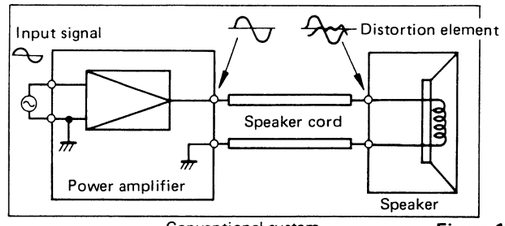
Like a microphone, a speaker has the property to generate an electricity when a coil moves. When a signal is entered into a speaker, an electromotive force is generated in the inverse direction to the input (back electromotive force).

Since this electromotive force is not completely proportional to an input signal due to an uneven magnetic field or uneven mechanical strength of an edge, the unproportioned part appears as a distortion at the speaker terminal. Since a speaker cord and amplifier has as resistor element, this distortion appears as a distortion at the speaker.

The clean drive system detects the above distortion element by means of a detection cord. (Little current flows in this cord, and no voltage drop occurs, permitting measurement of the voltage at the speaker terminal. The speaker cord resistance is also measured by this measurement.) The amplifier output can be increased and decreased simply by cancelling this voltage (distortion element). The loss of the amplifier output generated by the speaker cord resistance is also cancelled by the same way, and the voltage at the speaker input terminal becomes equal to the amplifier output voltage (complete constant voltage drive). In this way, the clean drive system cancells a distortion element and loss in the speaker code, and drives the speaker with a clean signal faithful to an input signal. Since an influence of the cord is eliminated, the frequency response becomes flat.

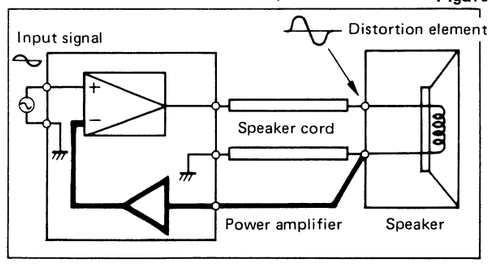
When seening the amplifier from the speaker input terminal, the resistance of the speaker cord is cancelled and the impedance becomes substantially zero(zero impedance drive).

This means that a damping factor is substantially infinite at the speaker input terminal.




Conventional system

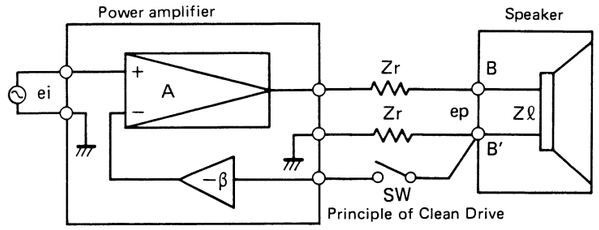
**Figure 18**




Newly developed clean drive system amplifier

**Figure 19**

**Principle of Clean Drive**




Principle of Clean Drive

**Figure 20**

ei: Input signal
ep: Voltage at the speaker terminal (BB')
Zr: Speaker cord impedance
Zℓ: Speaker cord impedance (including a non-linear component)
A: Amplifier gain
$\beta$: Feeback gain

**The voltage (ep) between the speaker terminals B and B' is obtained by the following equation.**

(1) Conventional system (SW OFF)

$$e_P = A \cdot \frac{1}{1+\frac{2Zr}{Z\ell}} \cdot e_i \quad \text{----------①}$$

This equation includes the term of a speaker impedance Zℓ. Since the Zℓ varies according to the frequency and contains a non-linear component, it is seen that the voltage at the speaker terminal has much distortion.

(2) Clean drive (SW ON)

$$e_P = A \cdot e_i \quad \text{----------②}$$

Assuming that $\beta = 2/A$, the voltage can be obtained by the following equation.

This equation doesn't have Zℓ and Zr terms, and it is seen that the voltage is proportional to an input voltage and has no distortion.



(Reference) Assuming that the voltage between the speaker terminals A and A' is eo with SW ON:

$$(e_i + \frac{e_0 Zr}{2Zr + Z\ell}\ \beta)\ A = e_0$$

$$e_iA + \frac{e_0 Zr\beta A}{2Zr + Z\ell} = e_0$$

$$e_iA\,(2Zr + Z\ell) + e_0 Zr\beta A = e_0\,(2Zr + Z\ell)$$

$$e_0\,(2Zr + Z\ell - Zr\beta A) = e_iA\,(2Zr + Z\ell)$$

$$e_0 = \frac{(2Zr + Z\ell)\,e_iA}{2Zr + Z\ell - Zr\beta A} \quad \text{----------①}$$

where,

$$e_0 = \frac{Z\ell}{2Zr + Z\ell} \cdot e_0 \quad \text{----------②}$$

Thus, when substituting the equation (2) and (1),

$$e_P = \frac{Z\ell}{(2Zr + Z\ell)} \cdot \frac{(2Zr + Z\ell)\,e_iA}{2Zr + Z\ell - r\beta A}$$

$$= \frac{e_i \cdot A \cdot Z\ell}{2Zr + Z\ell - Zr\beta A}$$

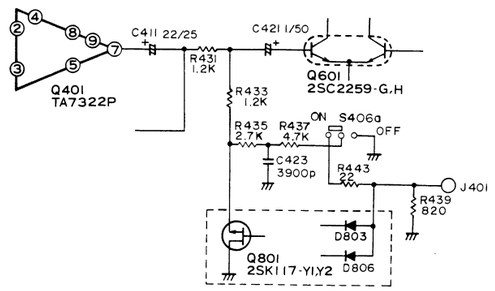
Assuming that $\beta = \frac{2}{A}$ in this equation,

$$e_P = \frac{e_iAZ\ell}{2Zr + Z\ell - ZrA \cdot \frac{2}{A}}$$

$$= \frac{e_iAZ\ell}{2Zr + Z\ell - 2Zr}$$

$$= \frac{e_iAZ\ell}{Z\ell} = e_iA$$

## Circuit Configuration of SB-66 Clean Drive




Protection Circuit for Clean Drive

**Figure 20**

R433 + R435 + R437=1.2K + 2.7K + 4.7K= 8.6K

$$\beta = \frac{R431}{R431 + (R433 + R435 + R437)} = \frac{1.2K}{1.2K + 8.6K}$$

$$= \frac{1.2K}{9.8K} \fallingdotseq 0.1$$

$$\frac{2}{A} = 2 \cdot \frac{R609}{R609 + R611} = 2 \cdot \frac{0.68}{0.68 + 12} = 2 \cdot \frac{0.68}{12.68}$$

$$= \frac{1.36}{12.68} \fallingdotseq 0.1$$

$$\beta = \frac{2}{A}$$

**Protection Circuit for Clean Drive**

This circuit protects an amplifier and speaker when the distortion detection cord is mistakenly connected to the plus side of a speaker.

**Operation**

When the distortion detection cord is connected to the plus side of a speaker, the power amplifier oscillates.

Rectify this oscillation voltage in both waves at D803 to D806, and aplly a plus voltage to the gate of SCR D802 and a minus voltage to the cathode, and turn on the SCR. Then, the transistor Q805 turns on, Q803 turns on, and FETs Q801 and Q802 turn and shorts the clean drive input circuit to stop oscillation.

At the same time, Q804 turns on, and IC TA 7317P Q807 operates to open the relay and separate the speaker.

This protects the amplifier and speaker from breakage and abnormal sound due to oscillation.

Since an abnormal phenomenon is an oscillation, the manual restoration using SCR is employed. Therefore, when an abnormal condition occurs, first turn off the power switch, and correct the wiring and turn on the power switch.

# 8. ELECTRICAL PARTS LOCATIONS

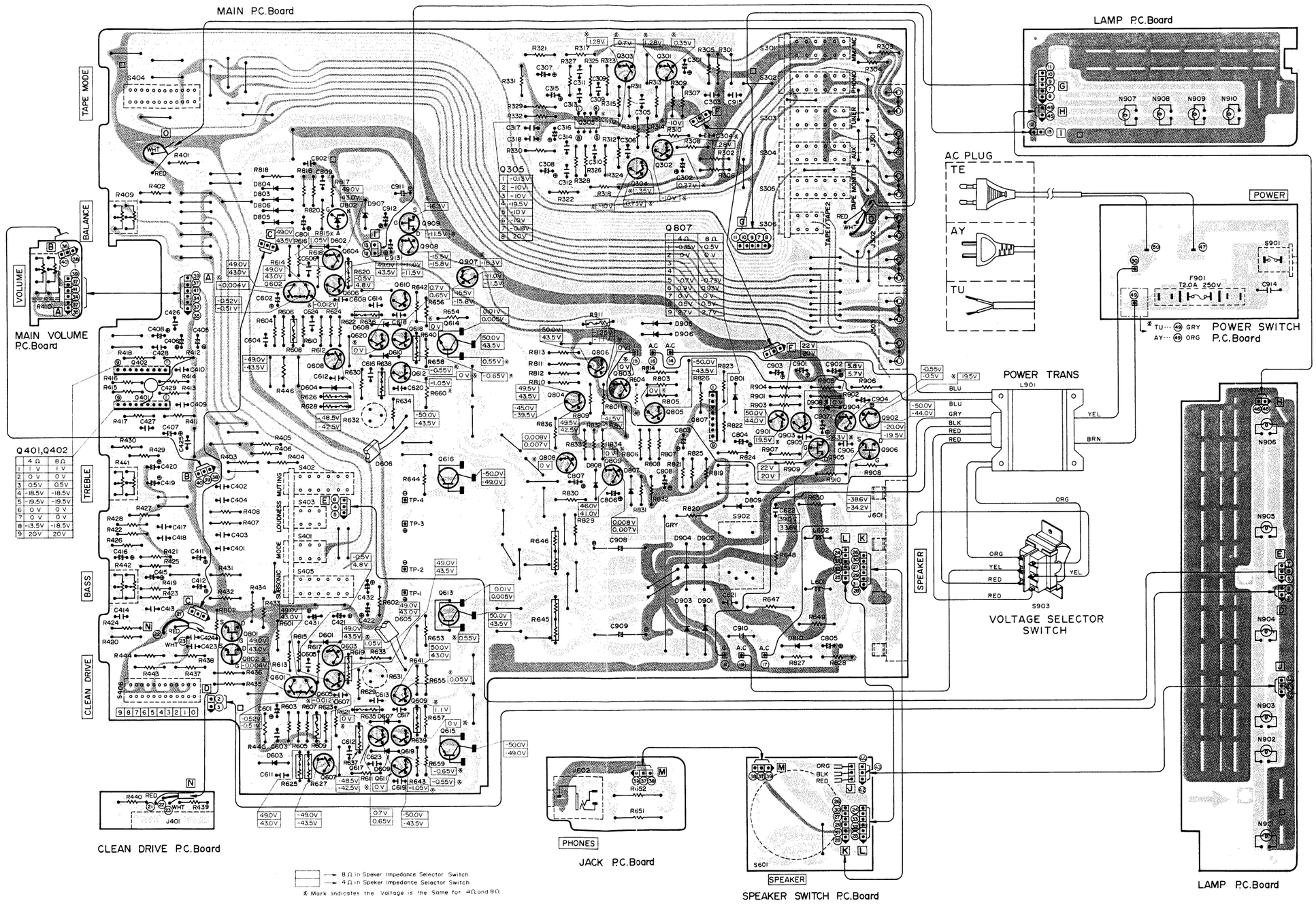



Figure 22

SB-66

# 9. SCHEMATIC DIAGRAM

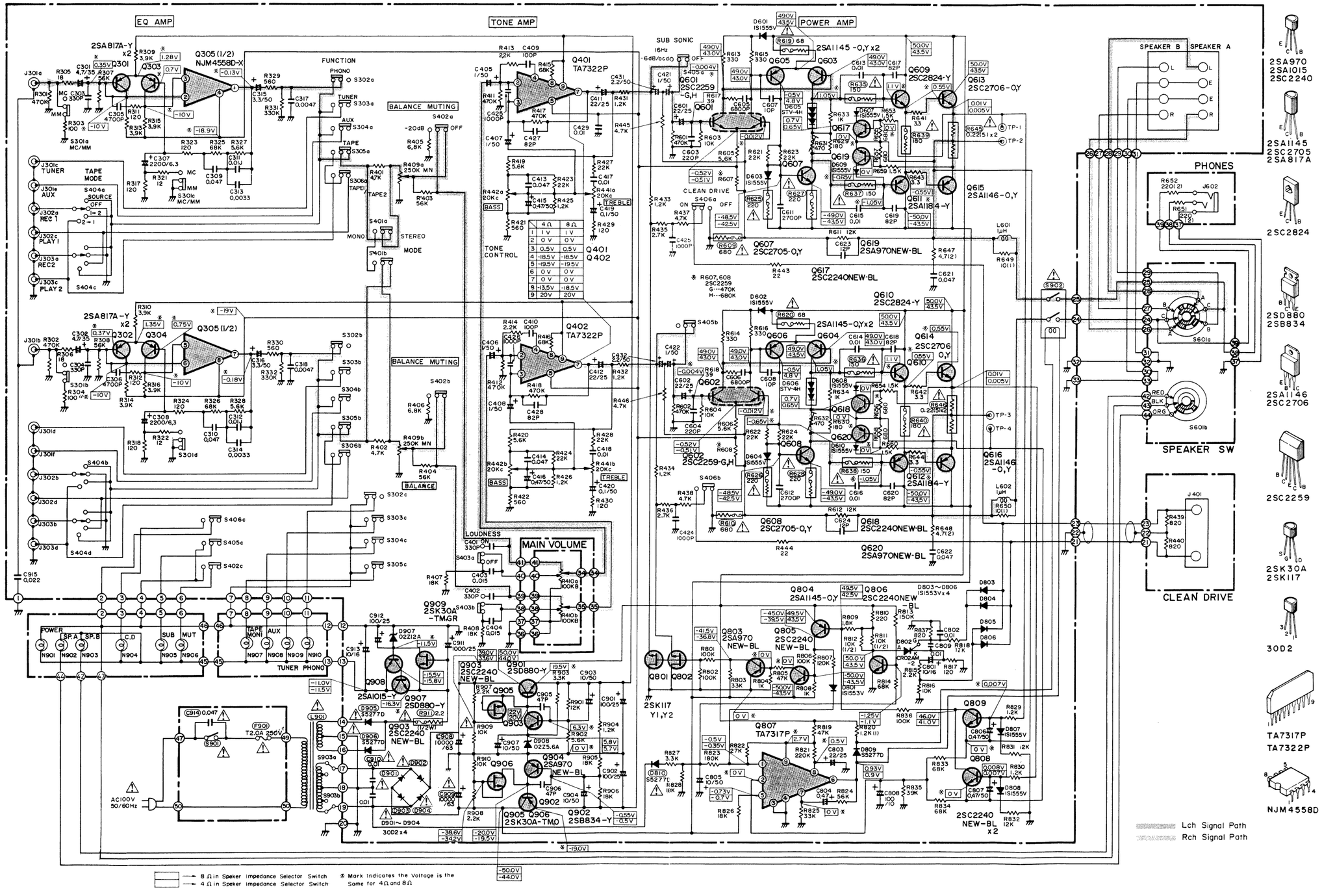


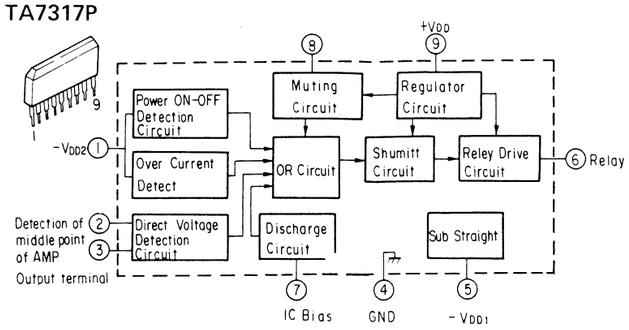

**Figure 23**



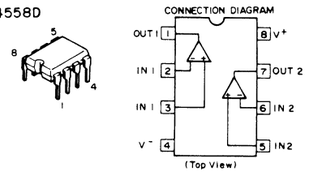
**CAUTION:**
The ⚠ mark, the symbol No. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replaced only with types identical to those in the original circuit or specified in the parts list.

# 10. IC BLOCK DIAGRAM

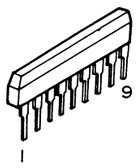
TA7317P




NJM4558D




TA7322P



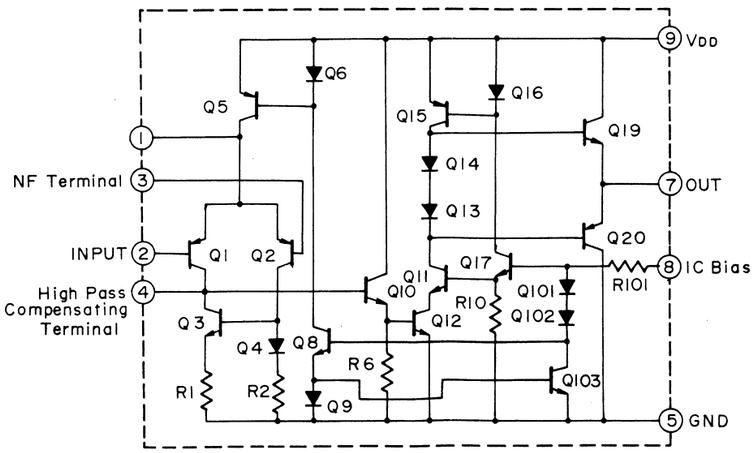




Figure 24



# 11. CABINET PARTS LOCATIONS

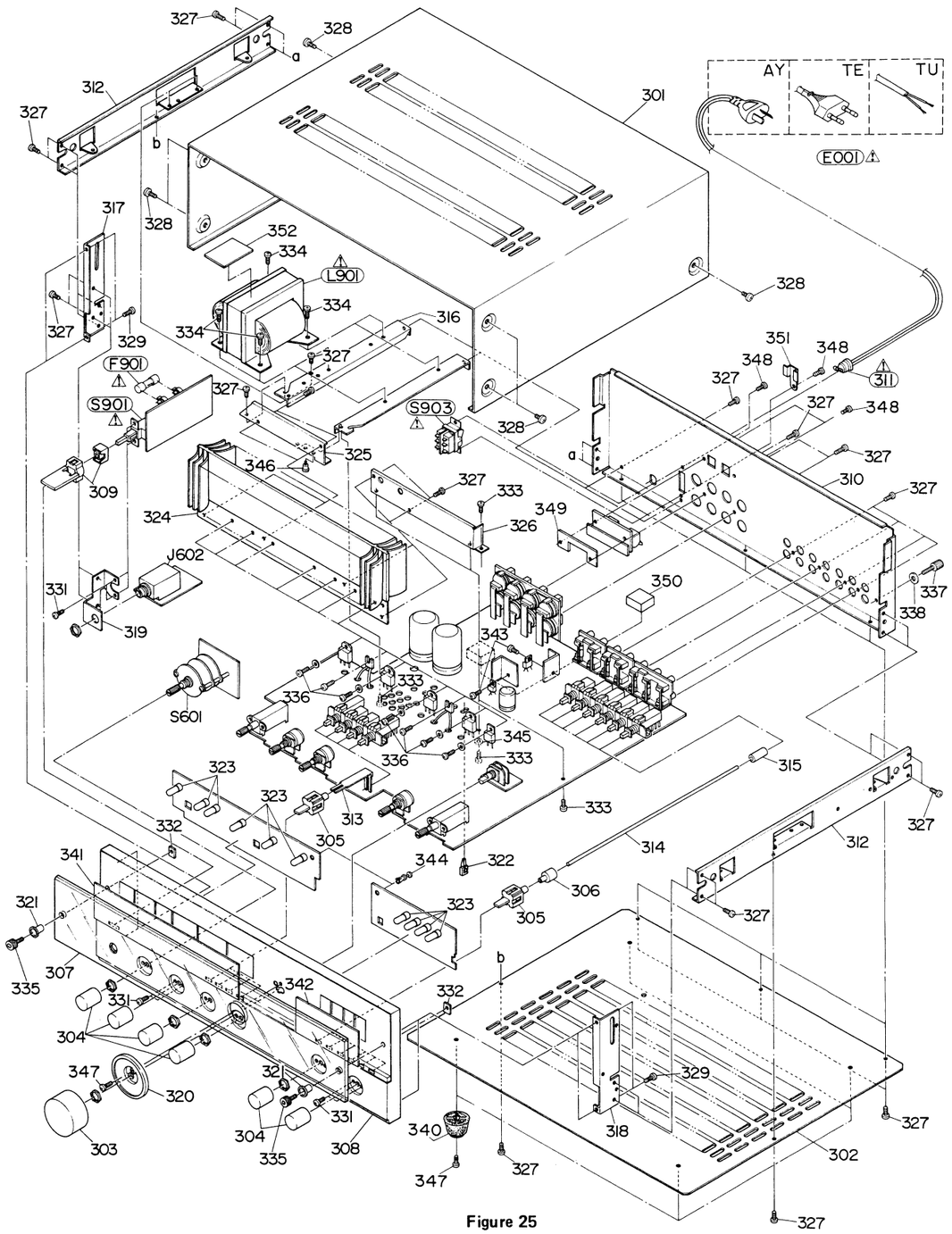



Figure 25

# 12. PARTS LIST

**CAUTION**
The ⚠ mark , the symbol No. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replaced only with types identical to those in the original circuit or specified in the parts list.

| Symbol No. | Part No. | Description |
|---|---|---|
| | | **CABINET PARTS** |
| 301 | 22841247 | Cover, Top |
| 303 | 22826312 | Knob, Volume |
| 304 | 22826313 | Knob, Tone |
| 305 | 25837472 | Knob, Push |
| 306 | 22753085 | Knob, Joint |
| 307 | 22830176 | Front Class |
| 308 | 22821585 | Panel Ass'y, Front |
| 309 | 22824354 | Knob, Power |
| 310 | 22712581 | Plate, Jack (TE) |
| 310 | 22712598 | Plate, Jack (TU, AY) |
| ⚠ 311 | 25845528 | Bush, Cord |
| 315 | 22755254 | Joint |
| 320 | 22833511 | Ring, Volume |
| 321 | 22833517 | Bushing, Panel |
| 323 | 22751189 | Holder, Lamp |
| 327 | 22701326 | Screw (BID), 3$\phi$ x 8mm, Tapping |
| 328 | 22707062 | Screw (FTBID), 4$\phi$ x 10mm |
| 329 | 22707165 | Screw (BID), 3$\phi$ x 10mm, Tapping |
| 331 | 22701394 | Screw (PAN), 3$\phi$ x 8mm |
| 332 | 22702179 | Nut, Plate |
| 333 | 22707115 | Screw (BID), 3$\phi$ x 8mm, Tapping |
| 334 | 22707185 | Screw (FTBID), 4$\phi$ x 8mm |
| 335 | 22707660 | Screw, 3$\phi$ x 10mm, Special |
| 336 | 22707163 | Screw (BID), 3$\phi$ x 10mm |
| 337 | 20794122 | Screw, Earth |
| 338 | 22703189 | Washer |
| 340 | 22828077 | Foot |
| 343 | 22707066 | Screw (BID), 3$\phi$ x 6mm |
| 344 | 22705022 | Rivet, Plastic, 3$\phi$ x 5.5mm |
| 346 | 22707394 | Screw, 3$\phi$ x 4mm, Special |
| 347 | 22707453 | Screw (BID), 3$\phi$ x 16mm,Tapping |
| 348 | 22701325 | Screw(BID) 3$\phi$ x 8mm |
| 352 | 22758294 | Cushion |
| | | **TRANSISTORS, IC'S AND DIODES** |
| Q301, 302 303, 304 | | Transistor, 2SA817A-Y |
| Q305 | 22114594 | IC, NJM4558D-K |
| Q401, 402 | | IC, TA7322P |
| Q601, 602 | 22114813 | Transistor, 2SC2259-G, H |
| Q603, 604 605, 605 | | Transistor, 2SA1145-O, Y |
| Q607, 608 | | Transistor, 2SC2705-O, Y |

| Symbol No. | Part No. | Description |
|---|---|---|
| Q609, 610 | | Transistor, 2SC2824-Y |
| Q611, 612 | | Transistor, 2SA1184-Y |
| Q613, 614 | | Transistor, 2SC2706-O, Y |
| Q615, 616 | | Transistor, 2SA1146-O, Y |
| Q617, 618 | | Transistor, 2SC2240-BL |
| Q619, 620 | | Transisotr, 2SA970-BL |
| Q801, 802 | | Transistor, 2SK117-Y1, Y2 |
| Q803 | | Transisotr, 2SA970-BL |
| Q804 | | Transistor, 2SA1145-O, Y |
| Q805, 806 | | Transistor, 2SC2240-BL |
| Q807 | | IC, TA7317P |
| Q808, 809 | | Transistor, 2SC2240-BL |
| Q901 | | Transisotr, 2SD880-Y |
| Q902 | | Transistor, 2SB834-Y |
| Q903 | | Transistor, 2SC2240-BL |
| Q904 | | Transistor, 2SA970-BL |
| Q905, 906 | | Transistor, 2SK30A-TM, O |
| Q907 | | Transistor, 2SD880-Y |
| Q908 | | Transisotr, 2SA1015-Y |
| Q909 | | Transisror, 2SK30A-TM, GR |
| D601, 602 603, 604 | | Diode, 1S1555V |
| D605, 606 | 22115424 | Diode, STV-4H |
| D607, 608 609, 610 | | Diode, 1S1555V |
| D801 | | Diode, 1S1553V |
| D802 | 22115652 | Diode, CR02AM-2 |
| D803, 804 805, 806 | | Diode, 1S1553V |
| D807, 808 | | Diode, 1S1555V |
| D809, 810 | | Diode, S5277D |
| ⚠ D901, 902 903, 904 | 22115601 | Diode, 30D2 |
| ⚠ D905, 906 | | Diode, S5277D |
| D907 | | Diode, 02Z12A |
| D908 | | Diode, 02Z5.6A |
| | | **ELECTRICAL PARTS** |
| L601, 602 | 22210107 | Coil, LH1101 |
| ⚠ T901 | 22223875 | Transformer, Power (TE) |
| ⚠ T901 | 22223916 | Transformer, Power (TU, AY) |

| Symbol No. | Part No. | Description |
|---|---|---|
| S301, 302 | 22195737 | Switch, Push, Function |
| 303, 304 | | MC/MM, PHONO, TUNER, |
| 305, 306 | | AUX, TAPE SOURCE, TAPE 1, 2 |
| S401, 402 | 22195736 | Switch, Push, MODE, MUTING, |
| 403, 405 | | LOUDNESS, SUBSONIC |
| S404 | 22195705 | Switch, Rotary, TAPE MODE |
| S406 | 22195713 | Switch, Rotary, CLEAN DRIVE |
| S601 | 22195669 | Switch, Rotary, SPEAKERS |
| ⚠ S901 | 22195631 | Switch, Push, Power |
| ⚠ S902 | 22148665 | Relay |
| ⚠ S903 | 22195716 | Switch, Seesaw, Voltage Select |
| J301 | 22163830 | Jack, US6P |
| J302, 303 | 22163831 | Jack, US4P, TAPE 1, TAPE 2 |
| J401 | 22162476 | Terminal, 2P, CLEAN DRIVE |
| J601 | 22162474 | Terminal, 8P, SPEAKER |
| J602 | 22163665 | Jack, Headphone |
| ⚠ F901 | 22144195 | Fuse, T 2.0A/250V |
| N901, 902 | 22113519 | Lamp, 14V, 50mA |
| 903, 904 | | |
| 905, 906 | | |
| 907, 908 | | |
| 909, 910 | | |
| ⚠ E001 | 22176286 | Cord, Power (TE) |
| ⚠ E001 | 22176536 | Cord, Power (TU) |
| ⚠ E001 | 22176588 | Cord, Power (AY) |
| EP01 | 22165047 | Holder, Fuse |

**CAPACITORS**

D = b 0.5pF, J = b 5%, K = b 10%, M = b 20%
ABBREVIATIONS: CD = Ceramic Disk, EL = Electrolytic, MY = Mylar

| | | |
|---|---|---|
| C301, 302 | 22467479 | EL, 4.7mfd, 35V, LS |
| C303, 304 | 22362331 | CD, 330pF, 50V, K |
| C305, 306 | 22349472 | CD, 4700pF, 50V, K |
| C307, 308 | 22482222 | EL, 2200mfd, 6.3V, M |
| C309, 310 | 22371473 | MY, 0.047mfd, 50V, J |
| C311, 312 | 22371103 | MY, 0.01mfd, 50V, J |
| C313, 314 | 22371332 | MY, 0.0033mfd, 50V, J |
| C315, 316 | 22488339 | EL, 3.3mfd, 50V, M |
| C317, 318 | 22371472 | MY, 0.0047mfd, 50V, J |
| C401, 402 | 22362331 | CD, 330pF, 50V, K |
| C403, 404 | 22371153 | MY, 0.015mfd, 50V, J |
| C405, 406 | 22488109 | EL, 1mfd, 50V, M |
| 407, 408 | | |

| Symbol No. | Part No. | Description |
|---|---|---|
| C409, 410 | 22362101 | CD, 100pF, 50V, K |
| C411, 412 | 22486220 | EL, 22mfd, 25V, M |
| C413, 414 | 22371473 | MY, 0.047mfd, 50V, J |
| C415, 416 | 22488478 | EL, 0.47mfd, 50V, M |
| C417, 418 | 22371103 | MY, 0.01mfd, 50V, J |
| C419, 420 | 22488108 | EL, 0.1mfd, 50V, M |
| C421, 422 | 22488109 | EL, 1mfd, 50V, M |
| C423, 424 | 22349102 | CD, 1000pF, 50V, K |
| C425, 426 | 22349102 | CD, 1000pF, 50V, K |
| C427, 428 | 22362820 | CD, 82pF, 50V, K |
| C429 | 22343103 | CD, 0.01mfd, 50V, K |
| C431, 432 | 22488229 | EL, 2,2mfd, 50V, M |
| C601, 602 | 22486220 | EL, 22mfd, 25V, M |
| C603, 604 | 22362221 | CD, 220pF, 50V, K |
| C605, 606 | 22349682 | CD, 6800pF, 50V, K |
| C607, 608 | 22361100 | CD, 10pF, 50V, D |
| C609, 610 | 22371683 | MY, 0.068mfd, 50V, J |
| C611, 612 | 22349272 | CD, 2700pF, 50V, K |
| C613, 614 | 22343103 | CD, 0.01mfd, 50V, M |
| 615, 616 | | |
| C617, 618 | 22362820 | CD, 82pF, 50V, K |
| 619, 620 | | |
| C621, 622 | 22371473 | MY, 0.047mfd, 50V, J |
| C623, 624 | 22362120 | CD, 12pF, 50V, K |
| C801 | 22485100 | EL, 10mfd, 16V, M |
| C802 | 22343103 | CD, 0.01mfd, 50V, M |
| C803 | 22486220 | EL, 22mfd, 25V, M |
| C804 | 22488478 | EL, 0.47mfd, 50V, M |
| C805 | 22488100 | EL, 10mfd, 50V, M |
| C806, 807 | 22488478 | EL, 0.47mfd, 50V, M |
| C808 | 22483101 | EL, 100mfd, 10V, M |
| C809 | 22343103 | CD, 0.01mfd, 50V, M |
| C901, 902 | 22486101 | EL, 100mfd, 25V, M |
| C903, 904 | 22488100 | EL, 10mfd, 50V, M |
| C905, 906 | 22362470 | CD, 47pF, 50V, K |
| C907 | 22488100 | EL, 10mfd, 50V, M |
| ⚠ C908, 909 | 22449103 | EL, 10000mfd, 63V |
| ⚠ C910 | 22340148 | CD, 0.01mfd x 2, AC500V |
| C911 | 22486102 | EL, 1000mfd, 25V, M |
| C912 | 22486101 | EL, 100mfd, 25V, M |
| C913 | 22485100 | EL, 10mfd, 16V, M |
| ⚠ C914 | 22340150 | EL, 0.047mfd, AC400V |

| Symbol No. | Part No. | Description |
|---|---|---|
| | | **RESISTORS** |
| | | All resistors are carbon film ¼W, ± 5% unless otherwise noted. K - 1000 |
| R301, 302 | 22545474 | 470K ohm |
| R303, 304 | 22545101 | 100 ohm |
| R305, 306 | 22545180 | 18 ohm |
| R307, 308 | 22545563 | 56K ohm |
| R309, 310 | 22545392 | 3.9K ohm |
| R311, 312 | 22545121 | 120 ohm |
| R313, 314 | 22545392 | 3.9K ohm |
| 315, 316 | | |
| R317, 318 | 22545121 | 120 ohm |
| R321, 322 | 22545120 | 12 ohm |
| R323, 324 | 22545121 | 120 ohm |
| R325, 326 | 22540471 | 68K ohm, ± 2% |
| R327, 328 | 22540470 | 5.6K ohm, ± 2% |
| R329, 330 | 2254561 | 560 ohm |
| R331, 332 | 22545334 | 330K ohm |
| R401, 402 | 22545472 | 4.7K ohm |
| R403, 404 | 22545563 | 56K ohm |
| R405, 406 | 22545682 | 6.8K ohm |
| R407, 408 | 22545183 | 18K ohm |
| R409 | 22620028 | 250K ohm, Variable |
| R410 | 22628413 | 100K ohm, B, Variable |
| R411, 412 | 22545474 | 470K ohm |
| R413, 414 | 22545222 | 2.2K ohm |
| R415, 416 | 22545683 | 68K ohm |
| R417, 418 | 22545474 | 470K ohm |
| R419, 420 | 22545562 | 5.6K ohm |
| R421, 422 | 22545561 | 560 ohm |
| R423, 424 | 22545223 | 22K ohm |
| R425, 426 | 22545122 | 1.2K ohm |
| R427, 428 | 22545223 | 22K ohm |
| R429, 430 | 22545221 | 220 ohm |
| R431, 432 | 22545122 | 1.2K ohm |
| 433, 434 | | |
| R435, 436 | 22545272 | 2.7K ohm |
| R437, 438 | 22545472 | 4.7K ohm |
| R439, 440 | 22545821 | 820 ohm |
| R441 | 22620030 | 20K ohm, C, Variable |
| R442 | 22620029 | 20K ohm, C, Variable |
| R443, 444 | 22545220 | 22 ohm |
| R445, 446 | 22545472 | 4.7K ohm |
| R601, 602 | 22545474 | 470K ohm |
| R603, 604 | 22545103 | 10K ohm |
| R605, 606 | 22545562 | 5.6K ohm |
| R607, 608 | 22545474 | 470K ohm, 2SC2259-G |
| | 22545684 | 680K ohm, 2SC2259-H |
| R609, 610 | 22500307 | 680 ohm, Fusible |
| R611, 612 | 22545123 | 12K ohm |

| Symbol No. | Part No. | Description |
|---|---|---|
| R613, 614 | 22545331 | 330 ohm |
| 615, 616 | | |
| R617, 618 | 22545390 | 39 ohm |
| ⚠ R619, 620 | 22500150 | 68 ohm, Fusible |
| R621, 622 | 22545223 | 22K ohm |
| 623, 624 | | |
| ⚠ R625, 626 | 22500117 | 220 ohm, Fusible |
| 627, 628 | | |
| R629, 630 | 22545181 | 180 ohm |
| R631, 632 | 2265260 | 470 ohm, Semi-fixed |
| R633, 634 | 22545102 | 1K ohm |
| ⚠ R635, 636 | 22500139 | 150 ohm, Fusible |
| 637, 638 | | |
| ⚠ R639, 640 | 22500136 | 180 ohm, Fusible |
| R641, 642 | 22545339 | 3.3 ohm |
| 643, 644 | | |
| ⚠ R645, 646 | 22500303 | 0.22 ohm x 2, 5W, ± 10% |
| ⚠ R647, 468 | 22570359 | 4.7 ohm, 2W |
| ⚠ R649, 650 | 22570250 | 10 ohm, 1W |
| ⚠ R651, 652 | 22570311 | 220 ohm, 2W |
| R653, 654 | 22545152 | 1.5K ohm |
| R655, 656 | 22545681 | 680 ohm |
| 657, 658 | | |
| R659, 660 | 22545152 | 1.5K ohm |
| R801, 802 | 22545104 | 100K ohm |
| R803 | 22545333 | 33K ohm |
| R804 | 22545102 | 1K ohm |
| R805 | 22545473 | 47K ohm |
| R806 | 22545104 | 100K ohm |
| R807 | 22545124 | 120K ohm |
| R808 | 22545102 | 1K ohm |
| R809 | 22545182 | 1.8K ohm |
| R810 | 22545221 | 220 ohm |
| R811, 812 | 22547103 | 10K ohm, ½W |
| R813 | 22545154 | 150K ohm |
| R814 | 22545683 | 68K ohm |
| R815 | 22545222 | 2.2K ohm |
| R816 | 22545103 | 10K ohm |
| R817 | 22545121 | 120 ohm |
| R818 | 22545123 | 12K ohm |
| R819 | 22545473 | 47K ohm |
| ⚠ R820 | 22570275 | 1.2K ohm, 1W |
| R821 | 22545224 | 220K ohm |
| R822 | 22545273 | 27K ohm |
| R823 | 22545273 | 180K ohm |
| R824 | 22545563 | 56K ohm |
| R825 | 22545333 | 33K ohm |
| R826 | 22545183 | 18K ohm |
| R827 | 22545332 | 3.3K ohm |
| R828 | 22545183 | 18K ohm |
| R829, 830 | 22545122 | 1.2K ohm |
| R831, 832 | 22545123 | 12K ohm |

| Symbol No. | Part No. | Description |
|---|---|---|
| R833, 834 | 22545683 | 68K ohm |
| R835 | 22545393 | 39K ohm |
| R836 | 22545104 | 100K ohm |
| R837 | 22545821 | 820 ohm |
| | | |
| R901 | 22545123 | 12K ohm |
| R902 | 22545562 | 5.6K ohm |
| R903 | 22545332 | 3,3K ohm |
| R904 | 22545122 | 1.2K ohm |
| R905, 906 | 22545183 | 18K ohm |
| R907, 908 | 22545222 | 2.2K ohm |
| R909, 910 | 22545103 | 10K ohm |
| ⚠ R911 | 22500202 | 2.2 ohm, ½W, Fusible |

| ACCESSORIES | | |
|---|---|---|
| AC01 | 22902831 | Owner's Manual |
| AC02 | 22170438 | Cord, CLEAN DRIVE (BLK) |
| AC03 | 22170439 | Cord, CLEAN DRIVE (GRY) |
| AC04 | 22162479 | Terminal, CLEAN DRIVE |